

*To the Chairman of the Scientific Jury,
Definitely by order,
№ RD - 38 - 570 / 03.12.2020
of the Rector of Sofia University "St. Kliment
Ohridski "*

R E V I E W

According to the documents of the Competition for the academic position "Professor" in the field of High education **4. Natural sciences**, mathematics and informatics, professional field **4.3. Biological sciences**, scientific specialty "**Microbiology**" (Microbiology - General and Food microbiology), Announced in the State Gazette, issue. 88 of 13.10.2020, with a single candidate: **Assoc. Prof. Dr. Petya Koycheva Hristova**

REVIEWER: Prof. Dr. Svetla Trifonova Danova, PhD, The Stephan Angeloff Institute of microbiology, BAS, Sofia, Bulgaria

1. Information about the competition:

The competition for "Professor" in the field of 4. Natural sciences, mathematics and informatics, professional field 4.3. Biological sciences, scientific specialty "Microbiology" (Microbiology - General and food microbiology) has been announced for the needs of Biological faculty at Sofia University "St. Kl. Ohridski" in the State Gazete no. 93 of 26.11.2019 with ORDER № RD - 38 - 570 / 03.12.2020. The scientific jury was formed on the basis of art. 4 and Art. 29a of the Law for the development of the academic staff in the Republic of Bulgaria, art. 60 et seq. Of the Regulations for application of ZRASRB, art. 118 para. (1) and (3) of the Regulations for the conditions and the order for acquiring scientific degrees and holding academic positions in Sofia University "St. Kliment Ohridski" and decision of the Faculty Council of the Faculty of Biology, protocol № 13 of 10.11.2020 in compliance with all legal provisions and the procedure under the Law on the Protection of the Functioning of Biological Sciences. Regardless of the extraordinary epidemic situation, the procedure for opening and announcing the competition has been observed: all the necessary documents specified in Art. 117 (1) of the Regulations of Sofia University "St. Kliment Ohridski " were provided on time; The competition is held with the help of the online platform of the University in compliance with the requirements of Art. 118 and Art. 119 of the same Regulations.

In my capacity as a reviewer, from the composition of the scientific jury, I declare that I have no conflict of interest within the meaning of paragraph 1, items 3 and 5 of ZRASRB with the candidate in the competition.

2. Career growth and professional qualities of the candidate

The only candidate who has submitted documents for participation in the competition for the academic position "Professor" in professional Field 4.3. Biological Sciences, specialty Microbiology (*Microbiology - General and Food Microbiology*) is Dr. Petya Koycheva Hristova, Associate Professor in the Department of General Microbiology at Biological faculty (BF- SU). She is a molecular biologist, specializing in General and Industrial Microbiology, graduated with honors in 1987 from the Faculty of Biology at Sofia University "St. Kliment Ohridski ". Her academic career began immediately after the defense of a dissertation before the specialized council of the Higher Attestation Commission for Microbiology, Immunology and Virology – 1997 year. She starts as an assistant in the Department of General and Industrial Microbiology - Chief Assistant and since 2012 she has been habilitated as an associate professor in the same department of BF-SU, as of 01.08.2012 year.

The presented CV and scientific works show a deep interest and accumulated professional experience in various current issues of molecular and general microbiology. As a PhD student (1994) she specialised in the Department of Biotechnology at the Technical University "Robert Gordon" - Aberdeen, Scotland on: "*Numerical taxonomy of microorganisms involved in the purification of drinking water by sand filters*" followed by another current topic: "Purification of divercin, a bacteriocin produced by *Carnobacterium divergens* V41" within the TEMPUS program. The knowledge and experience gained within the next 6 international specializations in France are essential for the establishment of Assoc. Prof. Hristova as an excellent microbiologist and lecturer seeking new aspects of modern microbiology and their introduction in updating the curricula of future biologists. The reason for this statement is given by the scientometric indicators, which I will discuss in detail in the review and the presented 3 textbooks / teaching aids for students. In addition, I would like to underline the serious administrative experience of Assoc. Prof. Hristova - as Deputy. Dean of the Bachelor's Degree (2016 - 2020), Head of the Master Programme "Food Quality and Safety" in Agrobiotechnology and Head of the Department of "General and Industrial Microbiology" (from 2016 to date) at the Faculty of Biology, Sofia University.

The candidate speaks 3 foreign languages (French, English and Russian) and has excellent organizational qualities, which I am convinced of when working together to prepare

graduates from Master's programs and other training events of the Department of General Microbiology. I would like to express my personal positive assessment of the personal qualities and professionalism of Assoc. Prof. Petya Hristova, who enthusiastically works for staff development in the Department, to preserve the traditions of BF training, while looking for ways to meet scientific challenges to biologists and the need for new knowledgeable professionals.

3. Evaluation of the scientific production and the scientometric indicators of the candidate

Assoc. Prof. Petya Hristova presents all documents required for the competition in compliance with the requirements of the ZRASRB, in accordance with Art. 117 of the Rules of Sofia University. They are arranged neatly, systematically with a clear distinction between the the works, which have participated in the competitions for PhD (ONS- "Doctor") and for obtaining the scientific degree "Associate Professor". The lists for participations in national and international scientific forums is presented together with information about the projects, scientific report on the contributions and for educational and teaching activities in the form generated by the system "*Authors*", Sofia University "St. Kliment Ohridski".

3.1. Characteristic and evaluation of the scientific-publishing activity

A list of a total of 65 scientific papers (publications, textbooks and teaching aids for students and online platforms) and 33 participations in international and national conferences, symposia / with a report, posters is attached The wide range of scientific topics concerning various current issues of general and food microbiology is impressive.

All scientific publications in referenced international and other publications, educational projects and textbooks, presented in the competition for the academic position "Professor", possess thematic focus in strict compliance with the theme of the competition. Thus, they are published after the competition for "Associate Professor", as follows:

- ✓ **Monograph** - P. Hristova "Cross-pathogens - new biological hazards in plant foods", ISBN 978-954-07-5035-4, Univ. publishing house "St. Kl. Ohridski ", 190 pages www.unipress.bg
- ✓ **Publications** in specialized, refereed and indexed foreign and our scientific journals with IF / SJR and quartiles **Q1-Q4 - 14;**
- ✓ Scientific and educational **publications** in peer - reviewed journals **without IF and SJR - 5**

✓ **Participation** in international and national scientific forums with **reports and posters 19;**

✓ **Textbooks** for students - **2 pieces** - Hristova P., S. Vlahov (2020) Microbiology, ISBN 978-619-91679-0-8, Sofia, 2020, 525 pages, and Hristova P. (2020) Pathogenic microorganisms, ISBN 978-619-91679-1-5, 150 pages, Sofia

The publications of the candidate (after associate professor) in editions with IF, SJR and quartiles (Q1-Q4), included in the international databases SCOPUS and WEB OF SCIENCE, make a good impression. From the presented documents it can be seen that these publications have a total IF = 10, 41. The total IF of all publications of Assoc. Prof. Hristova is **30,712**, which should be highly appreciated. Thematically, research is focused on solving important scientific challenges in modern microbiology - from new molecular genetic approaches in taxonomic research, in characterizing the molecular basis of pathogenesis in different groups of microorganisms to food and quality of life. I highly appreciate the two textbooks written for students.

3.2. Evaluation of citations of scientific papers

An objective assessment of a scientific work is its citation. The candidate presents a list of **283 citations**, (all after the competition for associate professor), entirely in international journals. This proves a serious international response to the developed and published works. Confirmation of the latter is the **h factor - 9** (according to Scopus).

3.3. Assessment of implementation of the minimum national requirements for the respective scientific field and the additional requirements of Sofia University “St. Kliment Ohridski ”

Regarding the minimum national criteria according to ZRASRB Assoc. Prof. P. Hristova participates in the competition with the following scientometric indicators:

According to **Indicator B**, the requirement of **100 points** is met on the basis of a published monograph on one of the current microbiological problems "*Cross-pathogens - the new biological hazards in plant foods*", 2020, ISBN 978-954-07-5035-4, Univ. publishing house "St. Kl. Ohridski.

- Evidence for 207 points out of the required 200 minimum points is presented under **Indicator G (“I”)**.

- However, the most impressive are the **566 items** presented under **indicator D** (formed from **127 Scopus citations**) and 156 (in other international databases), which is 5 times above the minimum 100 points required by law. The high citation rate of the works of Assoc. Prof. P.

Hristova in prestigious scientific publications, referenced in international databases are the best proof of their importance.

According to **Indicator E**: the candidate forms **220 points** with a minimum required **150 points** from the participation in 4 research projects and 1 national program "*Healthy foods for a strong bioeconomy and quality of life*" and participation in 4 international training programs (all after a competition for "Associate Professor"). Head of MSc Programme "*Food Quality and Safety*", specialty Agrobiotechnology.

Assoc. Prof. Hristova has supervised two successfully defended doctoral students and 20 graduates. This shows success not only in teaching but also in research and in finding funding to support research.

3.4. Assessment of teaching and learning activities, scientific guidance of students and administrative and managerial experience

Assoc. Prof. Petya Hristova is an established university lecturer with a lot of experience in academic subjects thematically related to the competition. As can be seen from the university report for the period 2015-2020, it has a total employment of **3550 teaching hours**, of which **2242** are classroom employment. She lectures on Microbiology for the Bachelor's Degree in Molecular Biology, Microbiology and Virology. Pharmacy; "Pathogenic microorganisms", "Molecular biology of prokaryotes and eukaryotes" "Food microbiology" "Biological hazards in food" from the curriculum of the Ministry of Culture "Food quality and safety" and "microbiology and microbiological control" in the Department of General Microbiology and BF . For the period between the two competitions, this makes an average class load: **448 hours** and an average total study load: **711 hours per academic year**. The candidate uses the experience from the teaching activity for creating and approving a curriculum of a new program "*Quality and food safety*" for full-time and part-time education in the qualification "Master; for the development and implementation of two compulsory courses: "Microbiological control of food and food products" and "Biological hazards in food". This proves the candidate's desire to work to improve training in the face of ever-emerging microbiological challenges. A fact that I appreciate especially now in the global Corona virus epidemic and the need for knowledgeable microbiologists and virologists

Assoc. Prof. Hristova actively participates in the preparation of doctoral students and graduates. In addition to successfully defending the two doctoral students, she currently supervises 3 other doctoral students. She is a research supervisor of 20 successfully defended Master's degree and two Bachelor's degree students at the Bulgarian Academy of Sciences.

Last but not least, I would like to mention the administrative and managerial experience of the candidate for the competition. Since 2016 she has been the Head of the Department of General and Industrial Microbiology and for 4 years he has been Deputy Dean of the Bachelor's Degree, Faculty of Biology, Sofia University. During this period, the Department of General and Industrial Microbiology renovated the training laboratories with the introduction of a new system for digitalized training in microbiology for students.

3.5. Evaluation of the project activity of the applicant

The presented report shows participation in 12 projects and training programs for the period of 9 years, after the competition for Associate Professor. Despite the serious teaching load, Assoc. Prof. P. Hristova successfully manages 4 projects funded by the NSF at Sofia University and is a member of the teams of 5 research projects funded by the Ministry of Education and Science, actively presenting in 3 international training programs. This shows success not only in teaching, but also in research and in finding funding to support research.

4. Evaluation of the original scientific contributions of the candidate

The main contributions of the research of Assoc. Prof. Petya Hristova are in the field of modern microbiology. A significant part of the presented works is devoted to the Molecular taxonomy of microorganisms with a proven contribution to the development of methods for molecular typing and identification of lactic acid and phytopathogenic bacteria. The candidate seeks answers to current scientific problems related to antibiotic resistance of clinical isolates with potential for cross-infections; with the microbiological control of foods and food additives and the production of biologically active substances of different origins. Modern metagenomic analyzes and assessment of the probiotic potential of lactic acid bacteria are of fundamental importance for the purposes of food microbiology and the potential for further applied developments.

All research is in the topic of the competition - General and food microbiology and can be systematized in general in the following areas: molecular taxonomy of microorganisms; biological hazards in food, antibiotic resistance to opportunistic pathogens, production of biologically active substances with antimicrobial action and microbiological control of probiotic products.

First of all, I would like to emphasize the importance of the problem to which the habilitation work is dedicated - the monograph "*Cross-pathogens - new biological hazards in plant foods*". Looking for answers to various scientific challenges, the candidate summarizes the latest information on the ability of human pathogens to persist in plants, maintain their

virulence to humans and cause plant diseases, as well as plant pathogens to cause human diseases. It is clearly shown that a new type of relationship has already been established in nature, which is important to study and control. An indisputable contribution, in line with the new European directives on food chain safety. The monograph makes an in-depth analysis of the data published so far on the molecular mechanisms for cross-pathogenicity, the establishment of specific gene profiles and microbial structures of cross-pathogens associated with plant colonization. This scientific-theoretical study proves the existence of a common plan for the infectious process and a common immune response in the cross kingdoms. A fundamental theoretical contribution to the work is to clarify the preconditions for the emergence of new cross-pathogens and to create evolutionary models that would explain the emergence of new relationships. This first introduction to the multidisciplinary arena of cross-pathogens on plants increases environmental awareness in the scientific community and can be developed as an interdisciplinary scientific field not only for the Department of General Microbiology, but also for BF at Sofia University. Evidence for which I find in scientific publications, which are referenced and indexed in world-famous databases (presented by indicator D.7).

The candidate has a clearly defined profile of research work, with international renown in the field of the following areas of General and Food Microbiology:

(1) Antibiotic resistance of opportunistic pathogens -

This is a kind of addition in the direction of new microbiological hazards and phytopathogens. The conditions under which opportunistic pathogens are selected that are highly competitive for nutrients and capable of producing many antimicrobial metabolites have been studied. The high density of microbial populations and rapidly changing conditions make the rhizosphere a unique habitat for terrestrial ecosystems. And these pathogens can easily pass into the food chain and, as carriers of high antibiotic resistance, create serious health problems. Research proves the need to use more than one method. to get good results. Original scientific and applied contributions to these studies are related to: (i) establishing the most effective rapid tests to detect producers of broad-spectrum beta-lactamases, carbapenemases and metallo-beta-lactamases, as the rapid and accurate identification of bacteria producing these enzymes is essential for the selection of appropriate antibiotic treatment and with (ii) demonstrating that the use of chromogenic agar has no advantage in detecting the production of ESBL enzymes and that there are differences in the sensitivity of phenotypic tests to detect MBL producers.

Phenotypic assays, Rosco MBL confirmation test (combination of IMP + DPA) identified the closest to RT-PCR method positive MBL isolates from *Pseudomonas spp.* and *A. baumannii*.

(2) The previous scientific researches have been enriched with important researches in the field of **Molecular identification and typing of phytopathogenic bacteria**. The development of rapid molecular analysis for amplification with species-specific primers is a significant practical contribution to the identification of three species of phytopathogens: *Xanthomonas vesicatoria*, *Xanthomonas euvesicatoria* and *Xanthomonas gardneri*. The validation of specific primers on more than 136 strains of *Xanthomonas* contributes to the study of the prevalence of these phytopathogens in crops. A new diagnostic algorithm for rapid identification of phytopathogens has been applied in order to track the ways of their penetration both in Bulgaria and in Macedonia.

For discriminant molecular typing of the genotype of phytopathogenic species *Xanthomonas*, the method of pulse electrophoresis (PFGE) has been applied, which is often used for epidemiological studies and analysis of foci caused by various pathogens. An important fundamental and applied contribution of this study is the tracing of the genetic diversity of a collection of 100 strains isolated during the period 1985–2012 from different varieties of *Solanum lycopersicum* L. and weeds from 11 geographical regions in Bulgaria. Two haplotypes for *Xanthomonas vesicatoria* and one haplotype for *Xanthomonas gardneri* strains have been found for our country. This proves that Assoc. Prof. Hristova is one of the few proven molecular microbiologists in this very topical issue.

(3) Preparation of biologically active substances with antimicrobial action

The growing resistance of pathogenic bacteria to the action of antibiotics is a challenge that requires the search for new antibacterial substances. Marine life is an excellent source of antimicrobial protein and is considered a promising candidate for the treatment of microbial infections. The study of the antimicrobial spectrum of hemocyanin by *Eriphia verrucosa* showed that native hemocyanin (EvH) has no biological activity unlike its five structural glycosylated units (SU), which show differentiated antibacterial activity. Of fundamental and practical importance are the results that the fraction with the highest glycan content has the potential to be used as a substitute for some commonly used antibiotics. An important scientific contribution is the evidence obtained that the degree of glycosylation of hemocyanin plays an important role in the manifestation of its functional antibacterial properties.

(4) The researches in the field of the **molecular identification and typing of the microorganisms in the foods** have an upgrading character. A significant part of the candidate's

research is aimed at creating and validating a common diagnostic algorithm, applicable for fast and accurate identification of microorganisms in dynamic microbial communities. Foods are an appropriate matrix for the validation of these studies and this has made a significant contribution to the diversification of approaches in food microbiology.

(5) Polyphasic-taxonomic characteristics of mixed biocenoses

The contributions to the study of the biodiversity of various unexplored or poorly studied communities are also indisputable. Biodiversity has been studied in mixed biocenoses such as rye dough, the intestinal tract of *Cornu aspersum*, bee *Apis mellifera* and probiotic food supplements. A polyphasic-taxonomic approach based on different phenotypic and genotypic methods has been successfully adapted to the analyzes of each of these specific habitats. For the first time in the scientific literature, the dynamic changes in the structure of the intestinal bacterial community of *C. aspersum* depending on the climatic seasons and their life cycle have been proven. An important practical application of the study is the validation of a complex approach of culture-independent molecular methods (ARDRA with endonucleases *HinfI* and *Csp6I*) cluster analysis and phenotypic culture methods.

I highly appreciate the research of the candidate related to the study of the organization of ribosomal operons of representatives of lactic acid bacteria. Based on the structure of ribosomal operons and the sequential polymorphism of 16S - 23S ribosomal intergenic regions (ITS) food.

An original contribution with scientific-theoretical and applied character is the isolation and identification for the first time from rye leaven in Bulgaria of the species *Lactobacillus spicheri*, *Lactobacillus paralimentarius*, *Lactobacillus kimchii* and *Lactobacillus sanfranciscensis*, as well as monitoring the dynamics of lactic acid fermentation.

The results obtained from the research are significant, clearly outline the scientific, scientific-applied and methodological contributions of the candidate with original and confirmatory character and prove the aspiration of Assoc. Prof. Hristova to meet the new challenges for microbiologists. At the same time, it has been proven that she works with young people - doctoral students and graduates, creating a school of knowledgeable specialists, which will build on what has been achieved tomorrow. In this regard, I note the contribution of the candidate to academic education - with the presentation of two textbooks for students of all biological specialties. (i) **textbook on Microbiology** (co-authored with Prof. S. Vlahov) which is a completely revised edition of the one from 2006. The modern development of molecular microbiology requires this edition. The textbook on Pathogenic Microorganisms is also up-to-

date and timely. An original way to consider the role of microorganisms in the infectious process in unity with the protective responses of their hosts. The mechanisms of action of the main groups of toxins are presented, as well as the factors of pathogenicity and virulence of selected, most common human pathogens. The textbook is intended for students of biological specialties who are interested in studying the pathogenic potential of microorganisms.

CONCLUSION

I give a high assessment of the research and teaching activities of Assoc. Prof. Dr. Petya Koycheva Hristova. I believe that with many years of dedicated research, proven professionalism and organizational skills, teaching skills and experience in project initiatives, it will contribute to the development of the Department of General Microbiology and the Faculty of Biology, developing an important interdisciplinary research field, called on the agenda by the new microbial hazards.

In conclusion, to the above, I believe that the candidate meets and even exceeds all the requirements of ZASRB and the Regulations for its implementation. I strongly suggest to the esteemed scientific jury and to the members of the Faculty Council of the Faculty of Biology to evaluate with dignity the candidacy of Associate Professor Dr. Petya Hristova and to vote positively for the scientific position "*Professor*" in professional field 4.3. Biological Sciences, Microbiology (General and Food Microbiology).

Sofia, Bulgaria

31.01.2021 г.

Reviewer:

Prof. Svetla Danova, Dsc